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Notes on the fern genus *Clathropteris*

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(WITH TWO TEXT-FIGURES)

Among the more fascinating objects of paleobotanical investigation are the abundant and varied forms which have now come to be rather generally recognized as constituting two distinct families of ferns, the Matoniaceae and the Dipteriaceae, members of which are such characteristic and striking objects in Mesozoic fern floras. This interest associated with their far distant ancestry is heightened by the fact of the singular association of the few surviving representatives of these two families at a limited number of localities in the oriental tropics.

It is not my purpose, however, to attempt an elaboration of this subject in the present connection, since it has already been discussed by others* and there is, moreover, a rather extensive literature dealing with the different extinct generic types that seem to be referable to the one or the other of these families. All that will be attempted in the present brief contribution will be the placing on record of certain observations on new material belonging to the genus *Clathropteris* and a discussion of its bearing on the probable habit of these ferns.

During a visit to the Richmond (Virginia) coal field during 1911 I collected for the United States National Museum a remarkably fine specimen of the so-called *Clathropteris platyphylla*, which, in so far as I recall, was the most complete specimen of this ubiquitous form that has ever been collected. This specimen was about 40 × 55 cm. and showed several dichotomies of the stipe. During its shipment to Washington the edges were broken and the surface abraded so that only a very inferior specimen remains. A counterpart of a portion of the face of this specimen

* Seward, A. C. On the structure and affinities of *Matonia pectinata*, R. Br., with notes on the geological history of the Matoniaceae. Phil. Trans. Roy. Soc. Lond. B, 191 : 171-209. 1899. Seward, A. C., & Dale, E. On the structure and affinities of *Dipteris*, with notes on the geological history of the Dipteridaceae. *Idem.*, B, 194 : 487-513. 1901.

was carefully brought back for the collections of the Johns Hopkins University and it is upon this fragment that the following remarks are mainly based.

The latter has maximum dimensions of about 22×27 cm. and shows a fragment of a large stipe 12 cm. long and 1 cm. in diameter, part of a whorl of large pinnae, and a fragment of the terminal part of a stipe with eight palmately arranged and mostly attached pinnae. Some of the marginal dentations of the pinnae are perfectly preserved, as is the peculiar netted venation. This specimen is shown in FIG. 1, one half natural size.

The genus *Clathropteris* was proposed by Brongniart* in 1828, the type being his *Filicites meniscioides*† from the Rhaetic beds of Hoer in Scania. In 1849 Brongniart‡ transferred the *Camptopteris platyphylla* of Goeppert§ to the genus *Clathropteris*, and these two species have usually been maintained as distinct, although Nathorst states|| that after an examination of Brongniart's type material of *Clathropteris meniscioides* he is convinced that it is identical with *Clathropteris platyphylla*. If this is true then the former name has priority.

The genus has been discussed recently by Nathorst (*op. cit.*), Zeiller** and Seward†† so that it is unnecessary to attempt to redefine it at the present time. Seward‡‡ has advocated the merging of *Clathropteris* and the allied genus *Thaumatopteris* Goeppert (*op. cit.*) with *Dictyophyllum*, but this course has fortunately not been followed, and Nathorst (*op. cit.*) has given excellent reasons why such a consideration would be unwarranted. The last author proposes that these fossil genera should be segregated from the existing family Dipteriaceae under the family name of Camptopteriaceae and on philosophical grounds it would seem that such a course would come nearer to representing the true status of these forms since the two groups are separated by the whole time interval of the

* Brongniart, A. *Prodrome*, 62. 1828.

† Brongniart, A. *Ann. Sci. Nat. Bot.* 4: 200. *pl. 11.* 1825.

‡ Brongniart, A. *Tableau* 32. 1849.

§ Goeppert, H. R. *Gen. pl. foss.* 5-6 : 120. *pl. 18, 19, f. 1-3.* 1846.

|| Nathorst, A. G. *Kgl. Svenska Vetens.-Akad. Handl.* 41 : 4. 1906.

** Zeiller, R. *Flore foss. gîtes charbon Tonkin. Ministère trav. publ. Études gîtes minér.* France, Atlas, 1902, texte, 1903.

†† Seward, A. C. *Fossil Plants* 2 : 386. 1910.

‡‡ Seward, A. C. *Phil. Trans. Roy. Soc. Lond. B*, 194 : 503. 1901.

Cenozoic, generally estimated at several millions of years, during which it is almost inconceivable that family boundaries did not shift. At the same time there seems to be a consensus of opinion that the existing Dipteriaceae represent the last relics of this adaptive radiation of the Camptopteriaceae, so that the question of family nomenclature is really not of great importance.

Specimens referable to *Clathropteris* and probably representing several botanical species, but not certainly distinguishable in the present state of our knowledge, have a very wide geographic and a very considerable geologic range. In this country they are found in the rocks of the Newark formation, probably of Keuper age, in Massachusetts, Connecticut, New Jersey and Virginia. They occur in the Keuper of Prussian Saxony and Switzerland. In the succeeding Rhaetic they are found in Sweden, Bornholm, Germany, France, England, Persia, China and Tonkin. In rocks referred to the lower Lias they are recorded from Hungary, Saxony, Silesia and France. Owing to the peculiar habit of these ferns and the often great length of the pinnae the specimens are usually much broken, the best foreign material probably being that described by Zeiller (*op. cit.*) from Tonkin.

As regards the habit it appears that the dichotomously forked rhizomes described by Nathorst (*op. cit.*) as *Rhizomopteris cruciata* represent the rhizomes of *Clathropteris*. The scars on these rhizomes indicate that in the Swedish region the fronds were not as crowded as they were in the allied *Dictyophyllum* growing at the same locality. The Virginia material shows that the stipes were stout and somewhat curved (in this respect suggesting *Mertensia*), as much as a centimeter in diameter, and with a longitudinally striated epidermis.

These stipes, rising for a considerable distance from the creeping rhizome, divided dichotomously at a wide angle and bore on the upper side of this fork from ten to thirty pinnae as in the genera *Dictyophyllum* and *Camptopteris*, species of both of which genera have been admirably restored by Nathorst. These pinnae are said to be fused proximad but it may be considered certain that the amount or absence of fusion was a variable feature as it is demonstrated to have been in the allied genus *Dictyophyllum*. It appears from Zeiller's Tonkin material that these primary pinnae

are more inclined to separation, are more slender, have simpler margins and are more numerous than those pinnae which I propose to consider as ultimate or secondary pinnae. I regard the

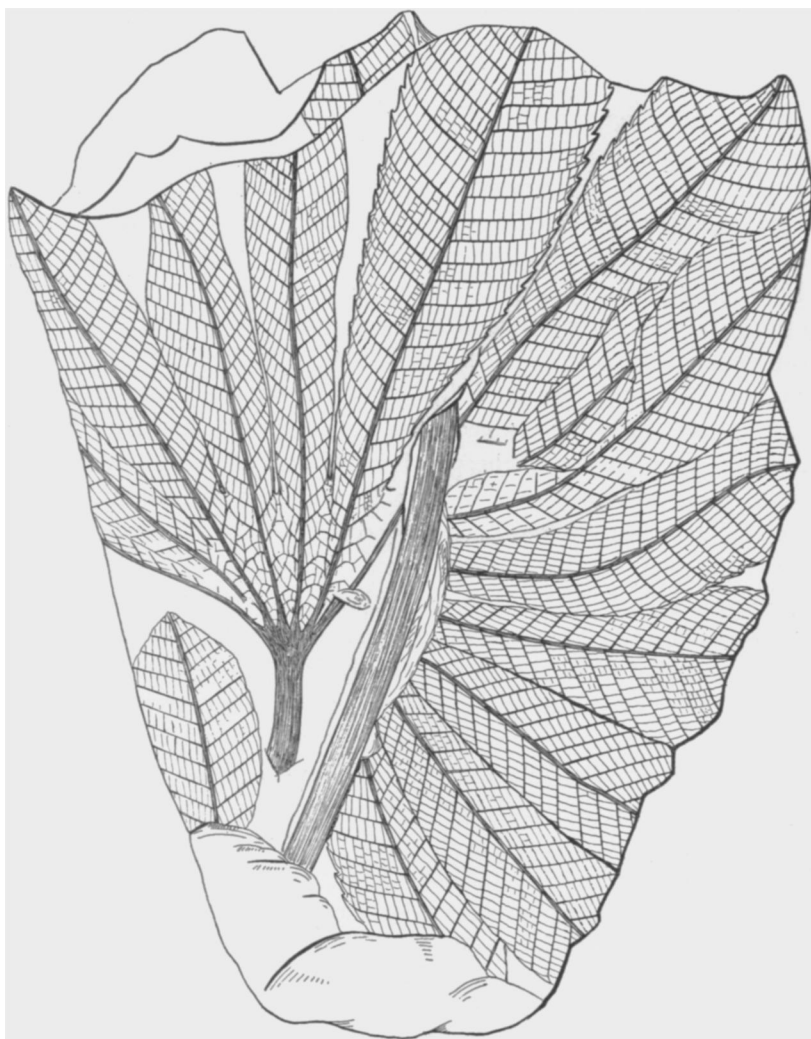


FIG. 1. Specimen of *Clathropteris platyphylla* from Triassic of Virginia, one half natural size.

palmately arranged pinnae on the right of the specimen figured (FIG. 1) as representing such primary pinnae. These are lanceolate in form, show a maximum width of 5 cm. at about one

third the distance above the base, and have an indicated length of about 30 cm. They taper conspicuously proximad and are still free at a point where their width has narrowed to less than 1.5 cm. Although their extreme bases are obliterated they were evidently either entirely separate or only slightly united. The margins are not entire but the marginal teeth are very much reduced, even at a distance of 10 cm. above the base, and proximad they appear to have been entirely wanting, although the preservation is not sufficiently good to be positive on this point.

It has been assumed by most students that the *Clathropteris* frond consisted of a single dichotomy and therefore had a habit somewhat like the modern *Dipteris* and more conspicuously like the existing *Matonia pectinata*, or like that of the extinct genus *Dictyophyllum* as restored by Nathorst. It would appear from the Virginia material that, in addition to such a group of what I have called primary pinnae, arranged *en éventail*, each branch of the dichotomy continued for some distance and then expanded into palmately arranged ultimate or secondary pinnae. These were fewer in number than those that I have called primary pinnae, being eight in the preserved material. They are wider and more conspicuously toothed and are clearly united for a distance of 3-5 cm. above their bases in my material.

While this interpretation is based in the first instance on material no longer extant and is therefore to be accepted with reserve, I feel justified in calling attention to it and in offering the tentative restoration of this interesting species as shown in FIG. 2. That the fronds were sometimes much larger than I have indicated is shown by fragments in my possession and by the extremely large fragments collected by Fontaine, which according to this author showed a width of pinnae of 20 cm. and an indicated length of 60 cm.

I have seen no fertile specimens from Virginia, but certain foreign material shows, on the lower surface of the lamina, an abundance of crowded sori without indusia and made up of from five to fifteen annulate sporangia, similar to those of *Dictyophyllum* and *Dipteris*, although the annulus is said by Goeppert to have been complete—a feature that it would seem would be impossible to decide in the absence of structural material.

The venation of *Clathropteris* has always excited great interest. In the proximal region where the pinnae are fused it is somewhat irregularly anastomosing, as is admirably shown in Zeiller's

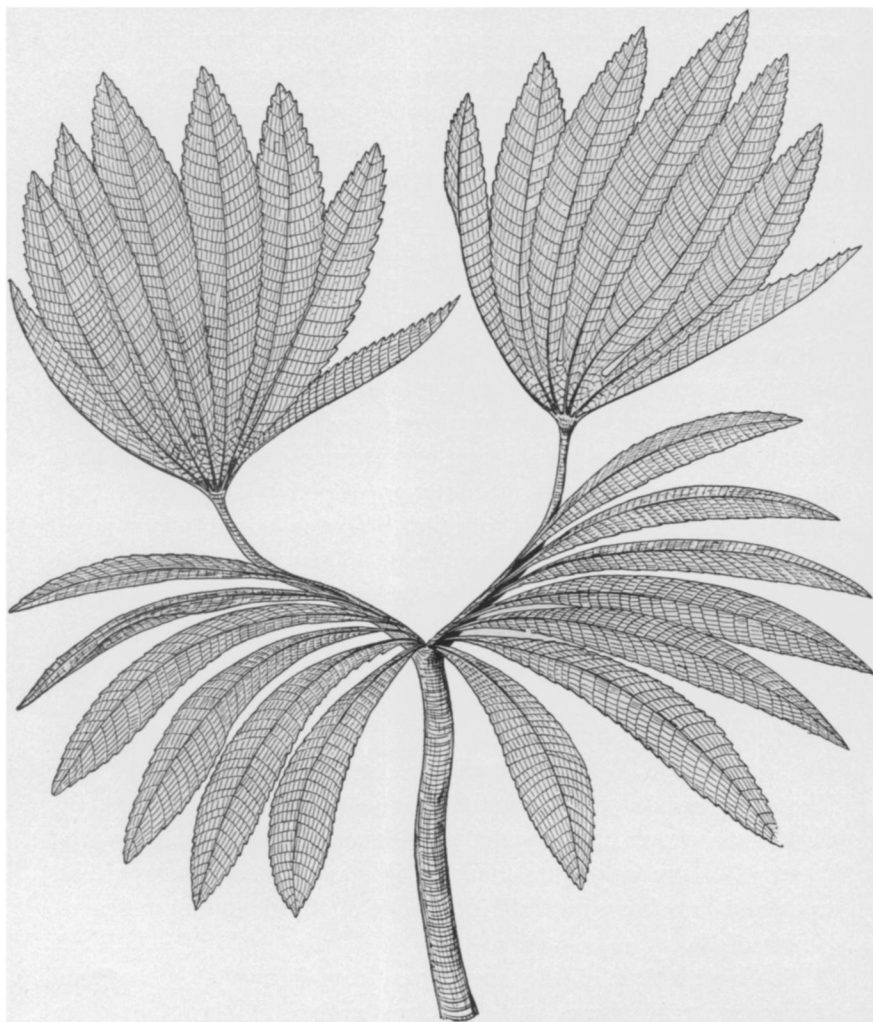


FIG. 2. Tentative restoration of *Clathropteris platyphylla*, one eighth natural size.

restoration.* In the free portion of the pinnae the very stout midribs give off, at regular intervals and at very wide angles ap-

* Zeiller, R. *Éléments de Paléobotanique*, 116, f. 89. 1900.

proaching 90 degrees, stout parallel secondaries. These usually alternate but not invariably. They proceed outward in almost straight courses nearly to the margin where they curve conspicuously upward, becoming rapidly much reduced in size and terminate at the tips of the marginal teeth. The secondaries are connected at approximately regular intervals by relatively stout straight percurrent tertiaries at nearly right angles to the secondaries, and subordinate divisions result in an ultimately fine rectangular areolation with blind endings.

This rectangular venation is rather consistently more regular than in the allied fossil genera and rather different from that of the existing Dipteriaceae. It is, however, approached very closely by certain existing Polypodiaceae with the so-called *Drynaria composita* type of venation. Among modern ferns that have a comparable venation might be mentioned various oriental species of Polypodiaceae, belonging to the genera *Lomariopsis*, *Dryostachyum*, *Polybotrya* and *Drynaria*. The latter genus is especially like *Clathropteris* in the form of its pinnules, in their venation and (in some of its species) in their toothed margins. *Drynaria* comprises about a dozen species of epiphytes of the oriental tropics and the species *Drynaria quercifolia* is particularly like *Clathropteris* in respect to the characters just enumerated, although the general habit is very different.

Although Schenk refers the fossil forms to the family Dictyopterideae, the venation characters, more readily ascertainable from fragmentary specimens, which are the kind usually collected, have resulted in the usual reference of the fossils to the Polypodiaceae or Acrostichaceae, as is done by Ettingshausen, although it is obvious that they constitute a unique and distinct line of forms ancestral to the modern family Dipteriaceae.

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